Aerosol Parameter Retrievals In The Korea - Sea Of Japan Coastal Region

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LONG-TERM GOALS

My long term goal is to understand the relationships of surface and remote optical measurements to the assessment of local and regional atmospheric transmission in optical wavelengths.

OBJECTIVES

This effort was planned to install and evaluate a new component of the NASA global sun photometer network (AERONET) in Chinhae, Republic of Korea in April and May 1999. The NRL effort collaborated with NASA GSFC in installation instrumentation, and comparison of preliminary output to surface measurements taken in Korea and other locations as available. . The purpose of the measurements is to investigate the use of the AERONET CIMEL sun photometer to retrieve air mass parameter information required as input into optical prediction models such as the Electro-Optical Tactical Decision Aid (EOTDA) and its follow-on the Target Acquisition Weather Software (TAWS).

APPROACH

The general approach was to install an AERONET sun photometer in Chinhae, Korea, and collect simultaneous measurement of optical depth. We simultaneously installed a three-wavelength integrating nephelometer to measure aerosol scattering at the photometer location. Data were collected for one week, although some of the time was spent in instrument installation and testing. This effort was conducted with Dr. Brent Holben of NASA-GSFC who provided and installed the sun photometer and collaborated on the data analysis. I also took advantage of the EOPACE experiment being conducted at Duck NC that included two sun photometers and three integrating nephelometers. These were used to compare nephelometer retrievals and simultaneous sun photometer retrievals.

WORK COMPLETED

The automated sun photometer has been installed at Chinhae and nephelometer data were collected and analyzed. Nephelometer data were collected at Duck NC and processed raw data were archived on the EOPACE web site. I have done a preliminary analysis of the results of the Korea data collection and compared these results to data collected at the Duck experiment.

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RESULTS

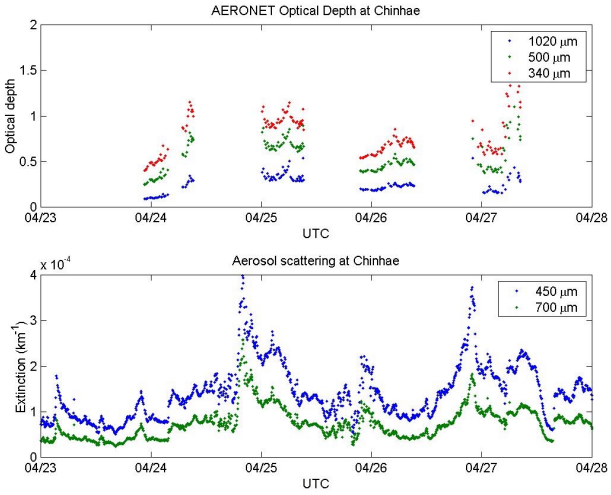

Figure 1. Comparison of sun photometer and aerosol scattering at Chinhae

Initial data comparisons show the Chinhae sun photometer optical depths and nephelometer scattering to be in general agreement. As shown in the first figures, there is a tendency to have a higher value of optical depth on 25 and 27 April than on 26 April, an observation which is consistent with the aerosol concentrations from the nephelometer, which are lower on the 26 than on 25 or 27 April. I also retrieved Angstrom coefficients (α) from nephelometer and AERONET data to demonstrate differences in aerosol size distribution.

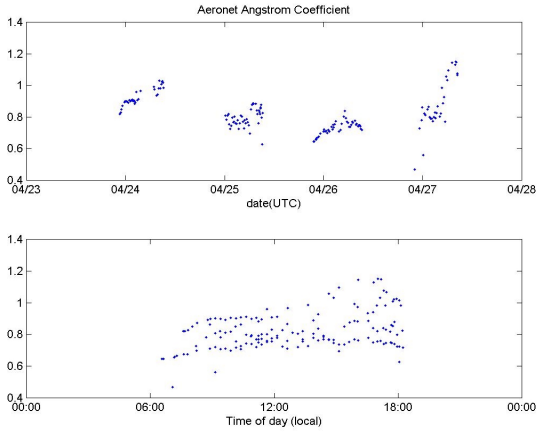

Figure 2. AERONET sun photometer Angstrom coefficient retrievals at Chinhae.

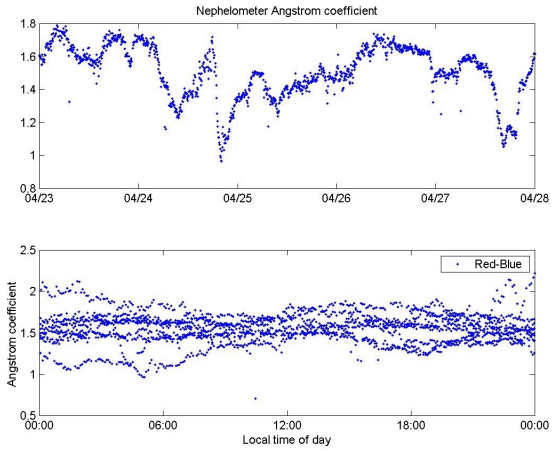

Figure 3. Nephelometer Angstrom coefficient retrievals at Chinhae.

Note the size distribution of the nephelometer is characteristic of the local aerosol, while that of the sun photometer is a property of the integrated atmospheric column. It was surprising to see the two coefficients to be substantially different with the nephelometer α~1.5 (more large aerosols), while for the sun photometer α~1 (fewer large aerosols).

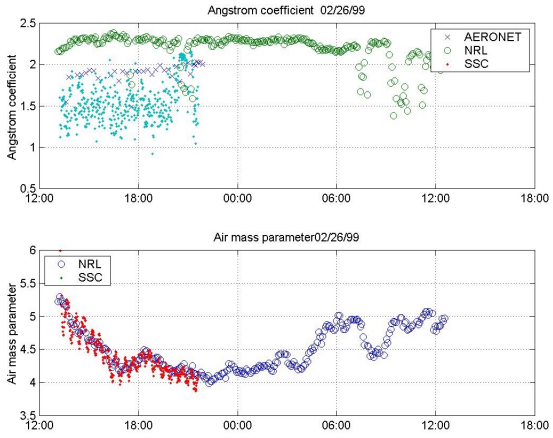

Figure 4. Angstrom coefficient retrieval at Duck NC from surface (SSC), tower(NRL) nephelometers and sun photometer (AERONET).

We conducted similar comparisons at Duck with a sun photometer, a nephelometer at ground level (by the shoreline) and a nephelometer on a 50 m tower. Similar calculations showed that the sun photometer α had a value midway between the surface and tower nephelometers. This was consistent with the hypothesis that large surface generated aerosols contributed most to the surface nephelometer, somewhat less to the sun photometer, and much less to the tower nephelometer. From this observation we conclude that the Korea sun photometer was affected by large particles aloft, which were not observed by the ground based nephelometer. I also calculated the air mass parameter (amplitude of the smallest size contribution to the Navy Aerosol Model) for both ground and tower based nephelometers. The values were similar indicating the similarity of the smaller part of the size distribution. The regular fluctuation of the SSC data was attributed to the heating of the SSC nephelometer intake

IMPACT/APPLICATIONS

These preliminary results strongly suggest that a combination of surface and column aerosol measurements could have important utility for inferring the vertical aerosol distribution of aerosol concentration and even potentially size distribution. The applications of this are substantial from the improvement of aerosol initialization of climate and weather models to the use of vertical aerosol distributions for calculation of slant path visible and infrared extinction coefficients.

TRANSITIONS

The Chinhae measurements are currently being collected and stored at NASA for distribution by the web as part of the global data collection for SEAWIFS and other climate modeling applications. The Duck data are being distributed on the web at the EOPACE site for the development of coastal aerosol models.

RELATED PROJECTS

This effort is closely related to the USN EOPACE project. The data collected and the techniques developed are being used for the development of the Navy coastal aerosol model, and for the development of measurement requirements for future Navy ships (MORIAH). The effort is also closely coupled to the NASA-GSFC AERONET program that is developing techniques for climate data collection and archiving.